

IC-2KL

500W ALL SOLID STATE LINEAR AMPLIFIER

INSTRUCTION MANUAL

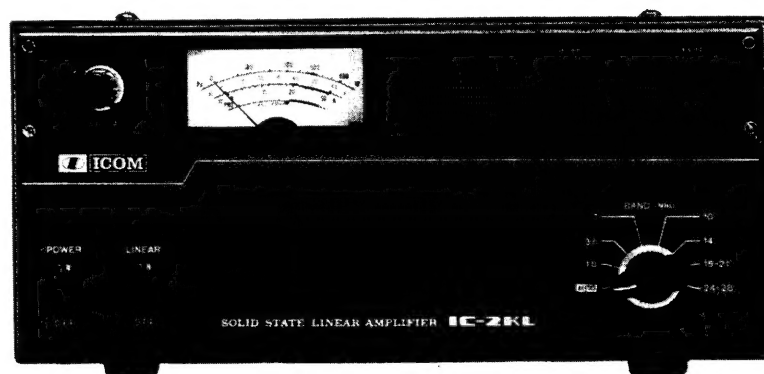


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SECTION I SPECIFICATIONS

LINEAR AMPLIFIER (IC-2KL)

Number of Semi-conductors	:	Transistor	24
		IC	3
		Diode	52 (U.S.A. version: 51)
Frequency Range	:	1.8:	1.8MHz ~ 2.0MHz
		3.5:	3.5MHz ~ 4.1MHz
		7:	6.9MHz ~ 7.5MHz
		10:	9.9MHz ~ 10.5MHz
		14:	13.9MHz ~ 14.5MHz
		18-21:	17.9MHz ~ 21.5MHz
		24-28:	24.5MHz ~ 30.0MHz (Not available in U.S.A. version)
Emission Modes and Duty Cycle	:	SSB	: 30 minutes max. with normal voice
		CW, RTTY:	Key down 10 minutes max.
Driving Power	:		50W ~ 80W
Input Impedance	:		50 ohms unbalanced
Rated Output Power	:	SSB	500W PEP
		CW	500W
		RTTY	500W
Output Impedance	:		50 ohms unbalanced
Spurious Emission	:		More than 60dB below peak power output
Third Order Distortion	:		More than 30dB below each tone of two-tone test
Protection Functions	:	Against:	Mismatching
			Overheating
			Overcurrent
			Overdriving
			Over-output power
			PA units unbalancing
Power Supply Requirement	:		40V DC $\pm 3V$, negative ground
			Current drain 23A max. (at 500W output)
			Attendant AC power supply IC-2KLPS is available.
Dimensions	:		111mm (H) x 241mm (W) x 300mm (D)
Weight	:		6.9kg

POWER SUPPLY (IC-2KLPS)

Number of Semi-conductors	:	Transistor	4
		Diode	8
Primary Power Requirement	:	Strappable for:	117V/240V $\pm 10\%$ 50 ~ 60Hz
			(100V/200V/220V use requires internal modification)
			1.6KVA
Output Voltage	:		40V DC $\pm 3V$ negative ground
Output Current	:		25A continuous 10 minutes max.
Dimensions	:		111mm (H) x 241mm (W) x 310mm (D)
Weight	:		13.6kg

SECTION II DESCRIPTION

ALL SOLID-STATE LINEAR AMPLIFIER

The IC-2KL is a complete solid-state kilowatt linear amplifier. It employs newly developed high power transistors which are designed for HF band SSB USE, as a parallel push-pull amplifier. These transistors have good linearity and high power (P_c : 300W) characteristics and give high performance.

ALL-BAND, INCLUDING NEW BANDS CAPABILITY

The IC-2KL covers all amateur HF bands from 1.8MHz to 28MHz including 10MHz, 18MHz and 24MHz bands which are the new bands decided by WARC-79. (The U.S.A. version is not provided with 24MHz and 28MHz.) When using the IC-720(A) as an exciter, you can enjoy real all band operation with their outstanding performance, matched tone, and compact size.

HEAT PIPE COOLING SYSTEM

The IC-2KL employs a heat pipe cooling system for the heatsink of the power transistors. The heat pipe is a new technology used to transfer heat. It has a very high heat conductance, i.e., more than several hundred times of that of copper, and quick response. Thus it is the most suitable for high power devices, such as linear amplifiers. In addition, it makes possible compact size, which can not be made by using existing vacuum tubes or usual heatsinks.

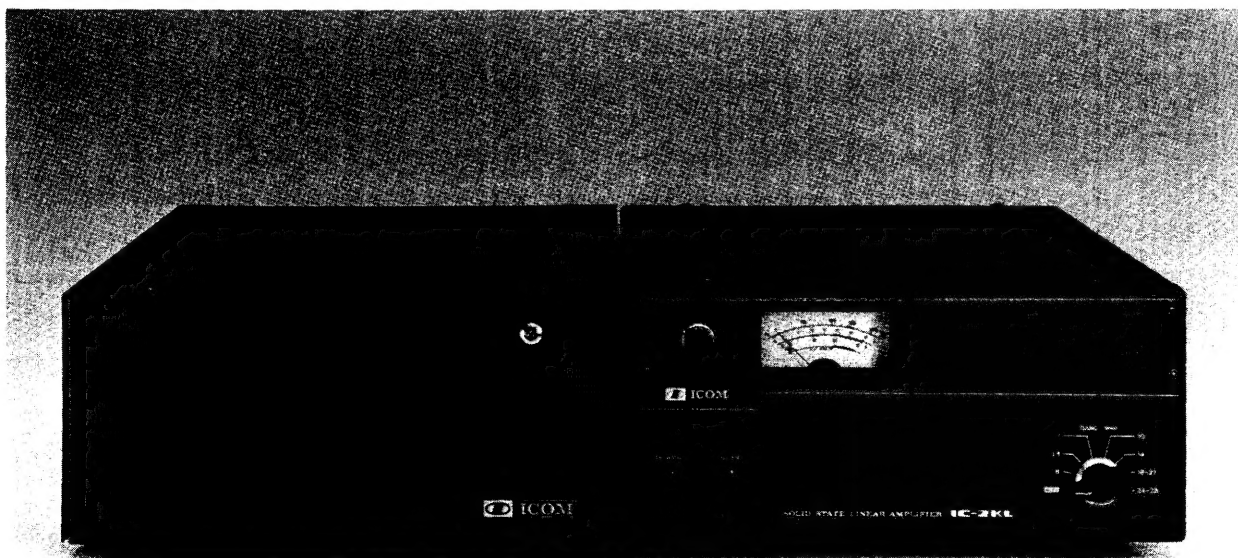
AUTOMATIC BAND SWITCHING AND NO TUNING UP OPERATION

When using an ICOM HF transceiver as an exciter, the transceiver puts out a band switch control signal, and the operating band of the IC-2KL follows the transceiver's automatically.

In addition, the IC-2KL is a wideband amplifier which needs no tuning up for any band or any frequency. So you can make quick QSY's, and have trouble-free operation.

PROTECTION CIRCUITS

A linear amplifier handles very high power, so if you mishandle the amplifier, it may interfere with other QSO's and damage the amplifier. However, the IC-2KL has several protection circuits which activate the ALC control voltage to reduce its driving power and/or shut off the amplifier to protect its transistors, depending on operating conditions. Thus you can enjoy high power operation without worry about interfering with other QSO's and damage to the amplifier.

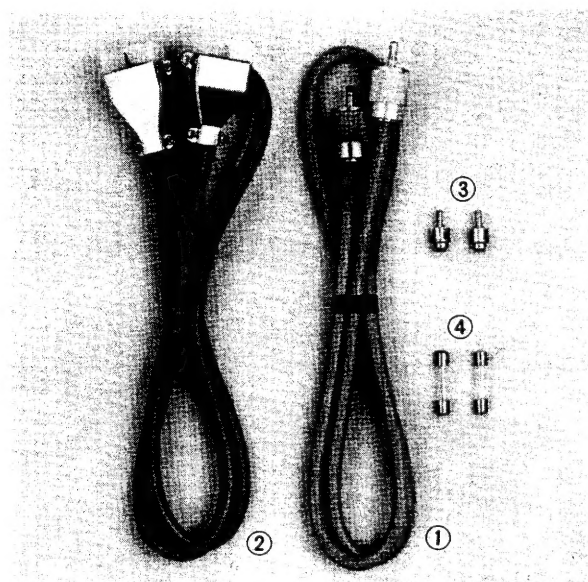


SECTION III INSTALLATION

UNPACKING

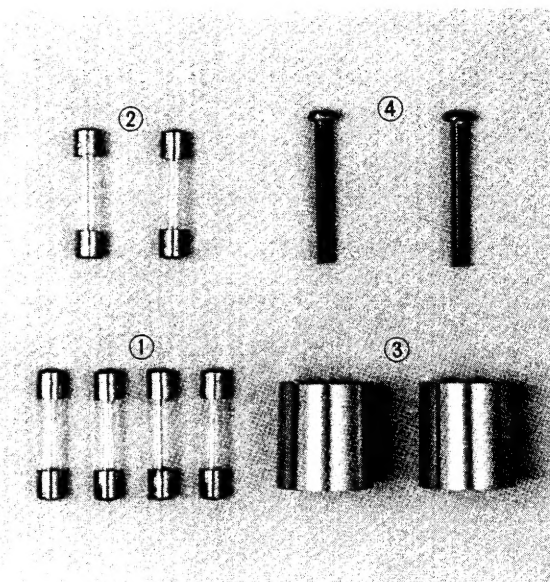
Carefully remove your amplifier and power supply from the packing cartons and examine them for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Accessory hardware, cables, etc., are packed with the sets. Make sure you have not overlooked anything.

IC-2KL



- | | |
|---|---|
| 1. Coaxial Cable (1m with PL-259's) | 1 |
| 2. Control Cable (1m) | 1 |
| 3. Pin Plug. | 2 |
| 4. Spare Fuse (30A for DC) | 2 |

IC-2KLPS



- | | |
|--------------------------------------|---|
| 1. Spare Fuse (10A for AC) | 4 |
| 2. Spare Fuse (30A for DC) | 2 |
| 3. Additional Tilt Leg | 2 |
| 4. Tilt Leg Fixing Screw. | 2 |

Be sure to read the following instructions before use.

RECOMMENDATIONS FOR INSTALLATION

1. Avoid placing the IC-2KL and IC-2KLPS in direct sunlight, high temperature, dusty or humid areas.
2. The IC-2KL has a forced ventilation system. There are air inlets in the bottom, and exhaust holes on the top.
Be sure that nothing is on top of, or just behind the set to ensure good ventilation.
3. Install the set on a level desk or rack for good air circulation in the heatsink. Don't lower the front.

POWER SUPPLY

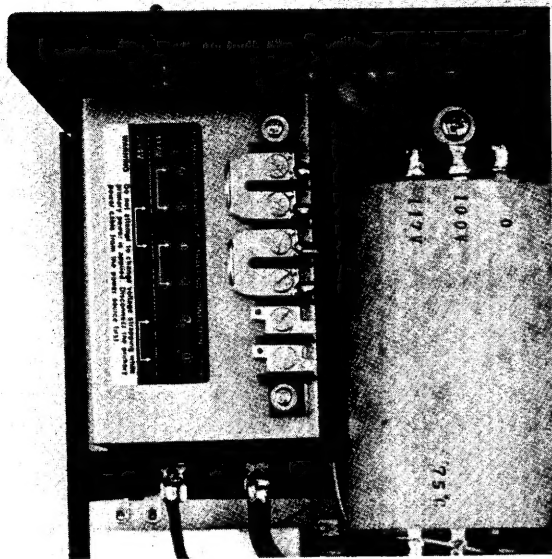
The IC-2KL requires DC 40 volts, 25 amps, so use the special matched power supply IC-2KLPS. It has a regulator for the set, and supplies steady power. However, when the AC power line has very poor regulation, the IC-2KLPS may not compensate for it, and the IC-2KL cannot give you the best performance. The maximum AC current consumption of the set during transmission runs about 14 amps, and this plus the current required for the exciter, etc., runs more than several amps at 117 volts.

So connect the sets to AC outlets that have enough capacity for them.

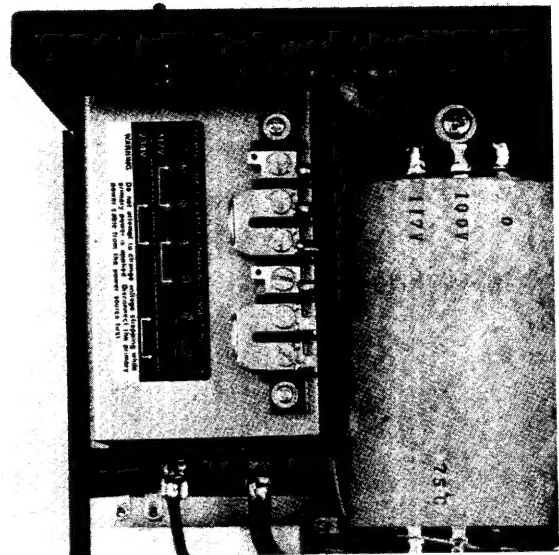
The power supply IC-2KLPS can be used for AC 117 volts or 235 volts by changing the connections of the internal terminals.

We recommend AC 235 volts operation, because the AC current will be decreased by half, and the AC line will keep good regulation. For terminal connections for AC 117 volt or 235 volt operation, refer to the following drawings.

For 117V



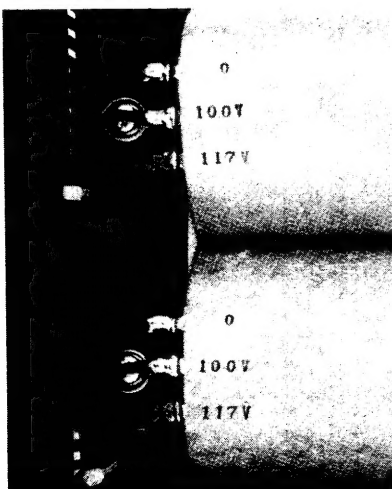
For 235V (240V)



CAUTION: The terminal strip is located inside of the lid. (Refer to page 9.)
 When you open this lid, unplug the AC plug.
 Tighten the terminal screws to prevent heating the terminals.

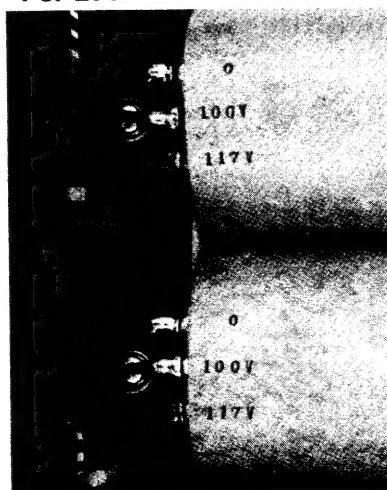
When you wish to use the IC-2KLPS for AC 100V, 200V or 220V, you must make internal wiring modifications as per the following drawings.

For 100V



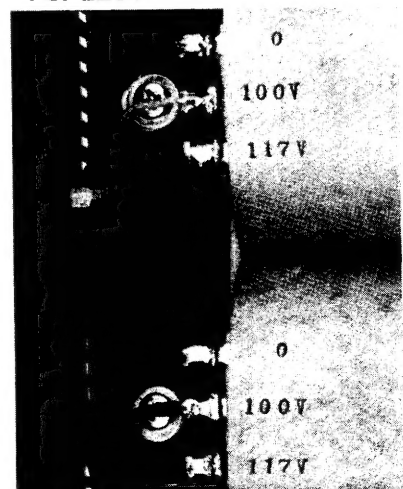
(The terminal connections are the same for 117V.)

For 200V



(The terminal connections are the same for 235V.)

For 220V



Make sure the wiring and the terminal connections are correct for the desired voltage before the IC-2KLPS is connected to the AC outlet. The fuse values do not need to be changed for any voltage.

EXCITER

The IC-2KL requires a transmitter or a transceiver as an exciter which has at least the following specifications:

Output power	80 watts or more
Output impedance	50 ohms
Operating Bands	One or more of 1.8MHz - 28MHz bands (including 10MHz, 18MHz, and 24MHz Bands)
Operating Modes	One or more of SSB, CW and RTTY

Also it requires an external ALC control terminal: (The IC-2KL puts out negative voltage for ALC control, and the exciter should be controlled with the negative voltage.) If the IC-2KL's ALC output terminal is not connected to the exciter's ALC input terminal, the IC-2KL protection circuit will not function properly.

ICOM's HF transceivers IC-701 and IC-720(A) meet these specifications, in addition they have the automatic band switching system which changes the operating band automatically. (IC-720 should have the optional LDA unit installed for automatic band switching.)

ANTENNA

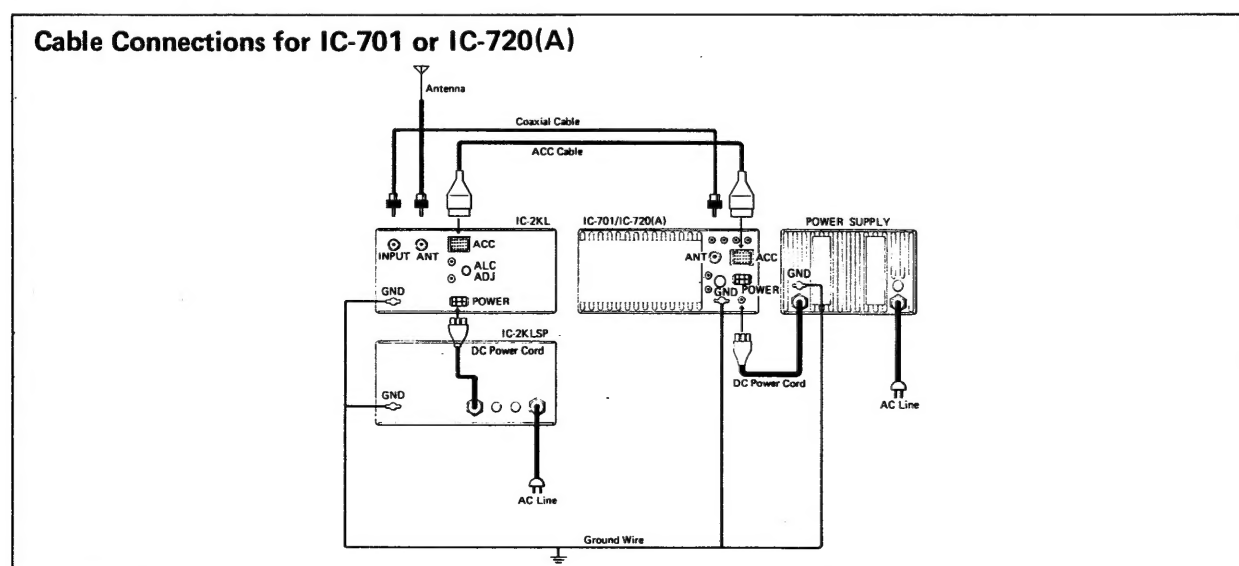
The IC-2KL handles very high power. So if you mishandle the IC-2KL, it is very dangerous to you and/or others and may damage the IC-2KL.

Take especial care of your antenna system as follows:

1. Use antenna(s) and feeder(s) which are capable of handling 1 KW CW, or more.
2. Its impedance should be 50 ohms, and the VSWR should be less than 1.5 at the operating frequency.
3. If you use an antenna tuner, make sure it is also capable of handling 1 KW CW or more, and it should be adjusted to get 1.5 or less VSWR before connecting it to the IC-2KL.
4. Make antenna element(s), radial(s) and/or open-wire feeder(s) (when you use them) safe against being touched by persons.

CABLE CONNECTIONS

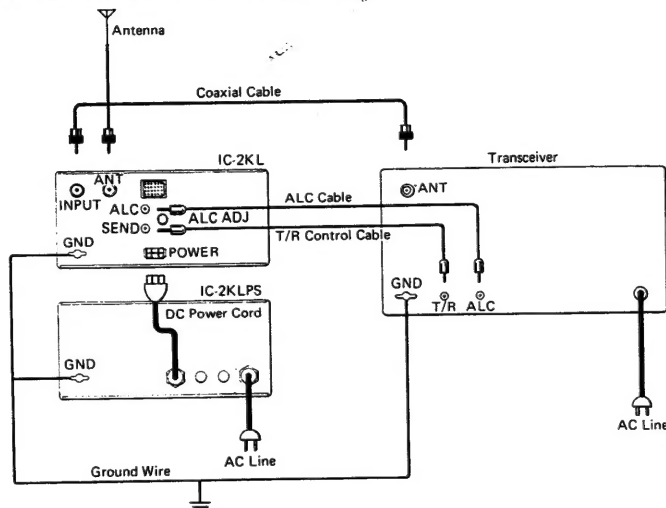
When you use the IC-701 or IC-720(A) as the exciter, connect the supplied cables in the manner shown.



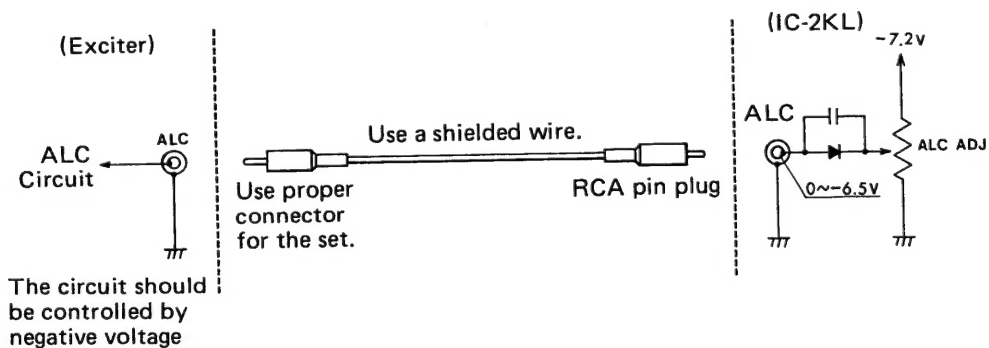
If you would like to use another transceiver as the exciter, use ALC and T/R switch control terminals as follows:

NOTE: When the exciter does not have an ALC control terminal, or is not controlled by negative ALC voltage, or when the ALC cable does not connect to the ALC control terminal of the exciter, the IC-2KL will not work normally. So be sure to make proper connections.

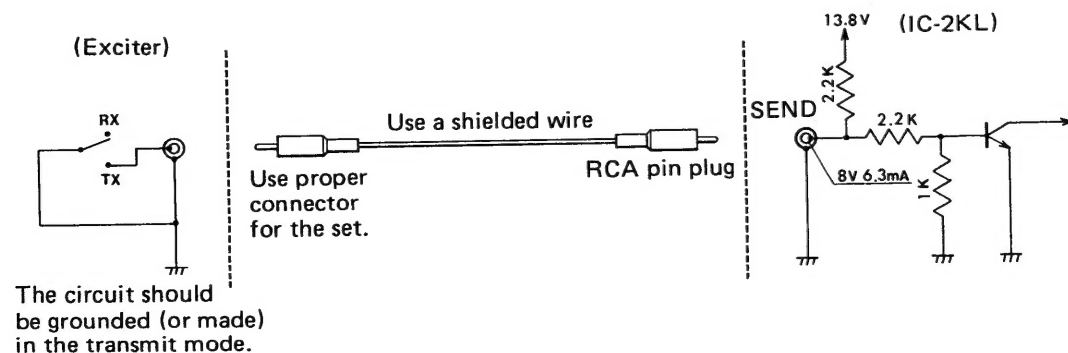
Cable Connections with Exciters Other Than ICOM



Connection of ALC Control Cable

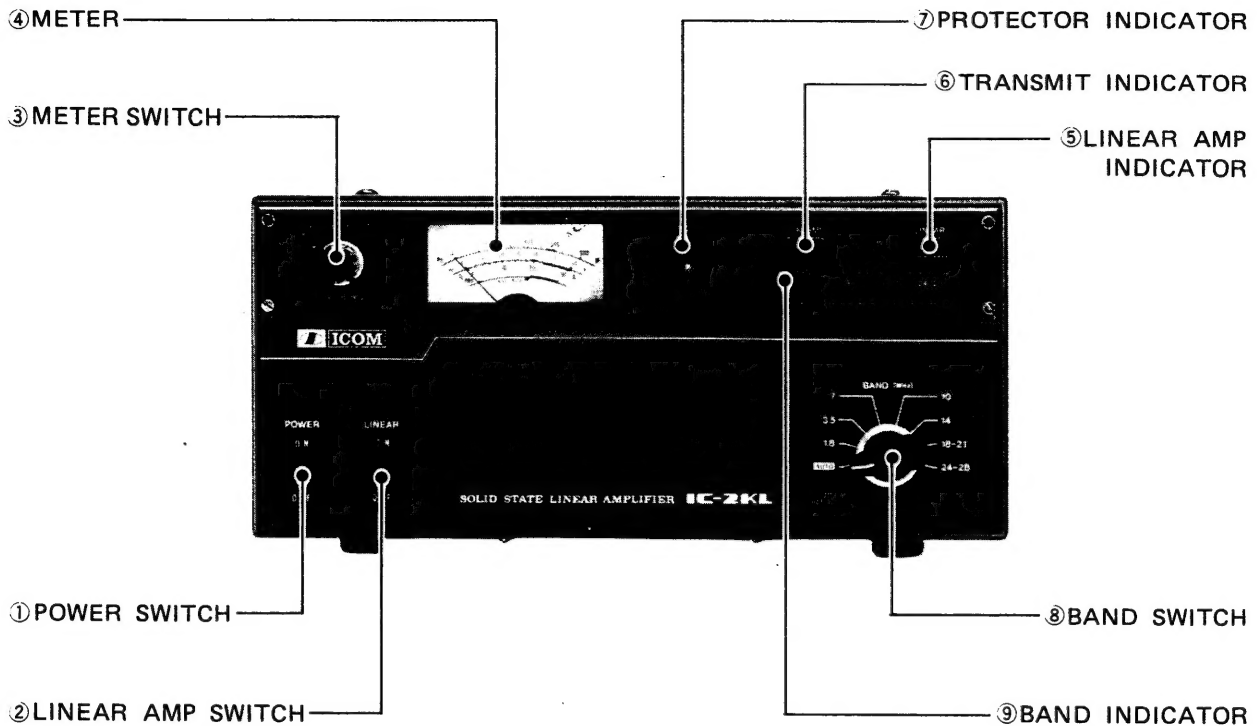


Connection of Transmit/Receive Switching Cable



SECTION IV CONTROL FUNCTIONS

FRONT PANEL



1. POWER SWITCH

Switches the input AC power to the external AC power supply, IC-2KLPS.

2. LINEAR AMP SWITCH

Switches the linear amplifier. In the ON position, the (5) LINEAR AMP INDICATOR is lit and the set acts as an amplifier depending on the Transmit/Receive switch of the exciter. In the OFF position, the amplifier does not work and the output power of the exciter is fed directly to the antenna.

3. METER SWITCH

Selects the function of the meter as follows:

1. Po Indicates the approximate output power of the amplifier.
2. Vc Indicates the collector voltage of the power amplifier transistors.
3. Ic Indicates the collector current of the power amplifier transistors.
4. PRO Indicates the operating condition of the protection circuit. The set should be used so that the meter needle is outside the marked range.

4. METER

Indicates the function selected by the (3) METER switch, and is illuminated when the (1) POWER SWITCH is turned ON.

5. LINEAR AMP INDICATOR

Illuminates when the (2) LINEAR AMP switch is turned ON.

6. TRANSMIT INDICATOR

Illuminates when the amplifier is in the transmit mode.

7. PROTECTOR INDICATOR

Illuminates when the protection circuit works. At the same time the amplifier stops transmitting and the output power of the exciter is fed directly to the antenna.

This condition can be reset by turning OFF the (2) LINEAR AMP switch. If the LINEAR AMP switch is turned OFF, and this condition remains, then it is caused by overheating of the PA units, and will continue until the temperature of the PA units go down to a safe level. This could be caused by antenna mismatch, environmental problems, etc., which must be corrected before beginning to operate again.

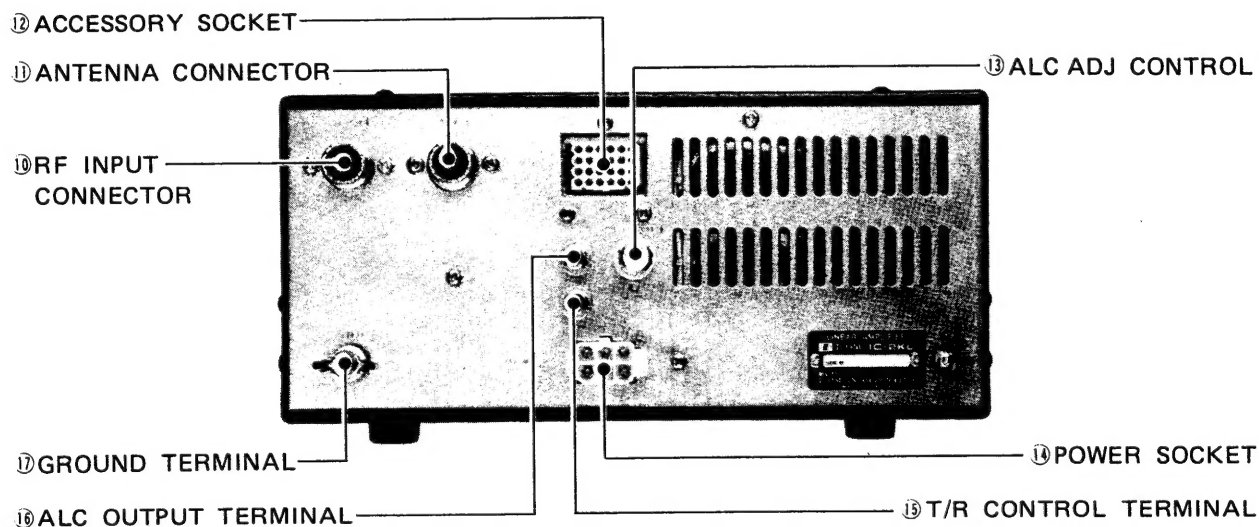
8. BAND SWITCH

Selects the operating band of the set. When you use the IC-701 or IC-720(A), set the BAND SWITCH in the AUTO position, then the operating band will follow the one selected by the exciter.

9. BAND INDICATOR

Indicates the operating band of the set. Make sure the band is the same band as the exciter.

REAR PANEL



10. RF INPUT CONNECTOR

Connects a coaxial cable, with a PL-259 connector, from the ANTENNA connector of the exciter.

11. ANTENNA CONNECTOR

Connects an antenna feeder, with a PL-259 connector. The feeder should be 50 ohms and capable of 1 KW CW.

12. ACCESSORY SOCKET

Connects the control cable from IC-720(A) or IC-701. Don't use this socket when you use an exciter other than ICOM's. (Refer to connections on page 12.)

13. ALC ADJ CONTROL

Controls the ALC output level.

14. POWER SOCKET

Connect the cable from the external power supply, IC-2KLPS, or suitable DC source to this socket.

15. T/R CONTROL TERMINAL

Connect the transmit/receive control cable from the exciter.

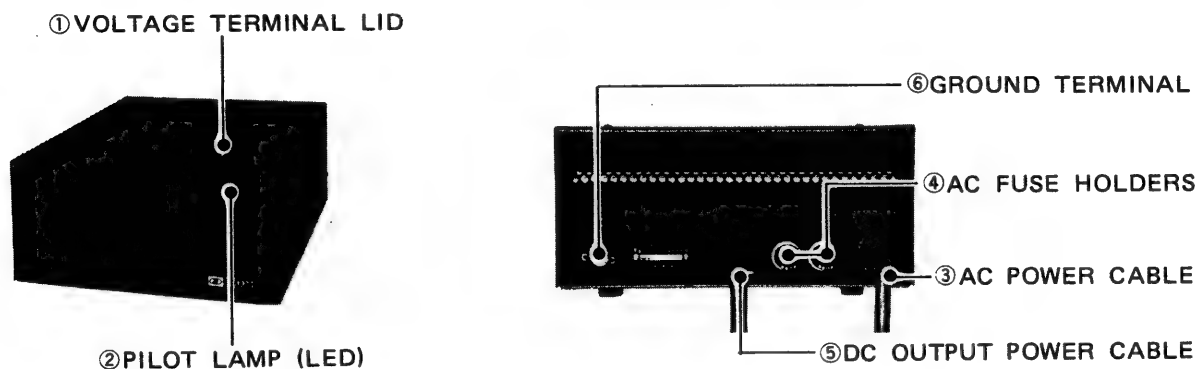
16. ALC OUTPUT TERMINAL

Puts out the ALC control voltage.

17. GROUND TERMINAL

To prevent electrical shock, TVI, BCI and other problems, be sure to ground the equipment through the GROUND TERMINAL. For best results use as heavy a gauge wire or strap as possible and make the connection as short as possible.

AC POWER SUPPLY IC-2KLPS



1. VOLTAGE TERMINAL LID

The AC primary voltage terminal strip is located inside of this lid.

2. PILOT LAMP (LED)

Illuminates when the POWER switch (of IC-2KL) is turned ON.

3. AC POWER CABLE

Connect this cable to an AC outlet which is capable of 1.6KW or more.

4. AC FUSE HOLDERS

Fuse holders for AC power line. If blown, replace them with 10A fuses after checking cause of problem. Use a Philips screwdriver to open the holders.

5. DC OUTPUT POWER CABLE

40V DC is available at up to 25A. Connect this plug to the power socket of the IC-2KL.

6. GROUND TERMINAL

Ground this terminal in the same manner as the IC-2KL's.

SECTION V OPERATION

After connecting an antenna, coaxial cable, etc., (Do not connect the AC power plug of the IC-2KLPS to an AC outlet yet), set knobs and switches as follows:

IC-2KL

POWER SWITCH	OFF
LINEAR AMP SWITCH	OFF
METER SWITCH	Vc
BAND SWITCH	AUTO (When using IC-701 or IC-720 with LDA unit installed) Desired Operating Band (When using another exciter. The band should be the same as the exciter's.)

EXCITER

POWER SWITCH	OFF
TRANSMIT/RECEIVE SWITCH	RECEIVE
MODE SWITCH	CW or RTTY
BAND SWITCH	Desired Operating Band

Set other knobs and switches according to the exciter's instructions.

Now connect the AC plug of the IC-2KLPS to an AC outlet and turn ON the power switches of the exciter and IC-2KL. The METER will be illuminated and "40V" will be indicated on the Vc scale, and the BAND INDICATOR will indicate the operating band.

ADJUSTMENT OF ALC LEVEL

Adjust the ALC level first. The adjustment can be made on any band, but make sure the exciter and IC-2KL are on the same band. When you use the IC-720(A) or IC-701 as an exciter and IC-2KL's band switch is set in the AUTO position, the IC-2KL's operating band follows the exciter's one.

Remove the cap of the ALC ADJ control on the rear panel.

Set the ALC ADJ control fully counterclockwise, and the METER switch on the front panel in the PRO position.

Keep the LINEAR AMP switch on the front panel in the OFF position, and set the exciter in the transmit mode and tune it up. Turn ON the LINEAR AMP switch, and set the exciter in the transmit mode and transmit carrier (on CW or RTTY) with full power condition.

Turn the ALC ADJ control clockwise until the meter deflection is on the "ALC ADJ" point on the PRO scale.

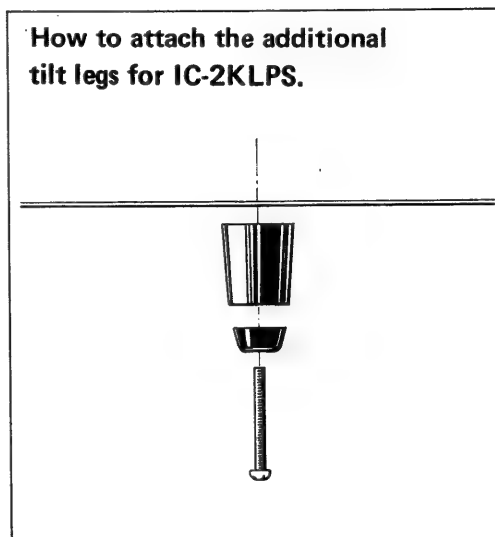
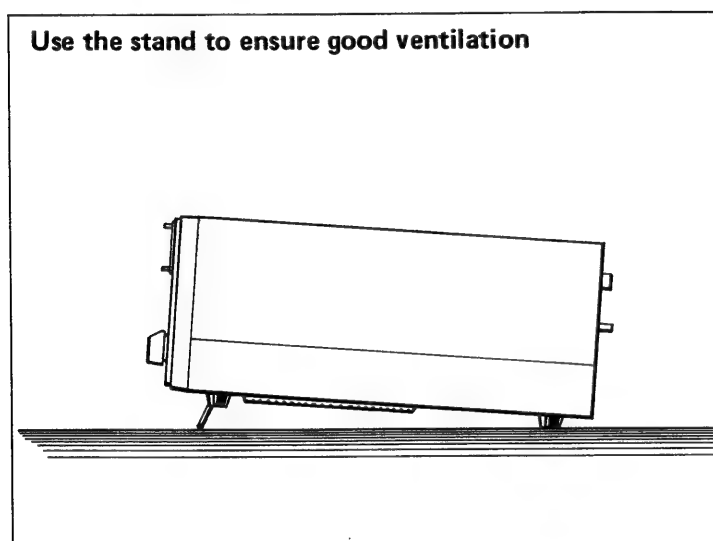
Set the METER switch to the Po position. You may read 500W on the meter when the SWR of the antenna is low enough, and the primary AC voltage and the driving power are at proper level. Now you can operate the IC-2KL.

OPERATION

The set does not need tuning up on any band, but make sure of the following before operation:

1. The set and the exciter are on the same band. When the exciter is an IC-720(A) or IC-701, set the band switch of IC-2KL in the AUTO position. The operating band of IC-2KL will follow the exciter's.

2. Control the MIC Gain or driving level of the exciter to make it have a proper ALC level. The ALC level may change when the amplifier is turned ON.
3. Check the SWR of the antenna(s) at times, and maintain good conditions.
4. When operating on CW or RTTY, do not exceed 10 minutes transmit continuously. If you wish to transmit more than 10 minutes, reduce the driving power from the exciter and be sure to use the stand of the IC-2KL to ensure good ventilation from the bottom.
5. When the protection circuit has been actuated, turn OFF the LINEAR AMP switch first, check for the cause and correct any improper condition, then turn ON the LINEAR AMP switch and operate again.



PROTECTION CIRCUIT

The IC-2KL's protection circuit has two major functions.

One is to put out ALC control voltage and to decrease the driving power from the exciter. This decreases the input power of the power amplifier and protects the PA transistors.

The other is to shut down the amplifier and protect the PA transistors; at the same time, it prevents abnormal operation.

The first functions in the following cases:

1. The output power goes up more than 500 watts.
2. The total collector current of the PA transistors goes up to more than 23 amps.
3. The driving power from the exciter goes up to more than 70 watts.
4. The VSWR of the output load goes up more than 2.0.

In each case, the set puts out the ALC control voltage, and it decreases the driving power and protects the PA transistors.

The second one functions in the following cases:

1. The temperature of the block attached to the PA transistors goes up to more than 80°C.
2. The output power of the two PA units are quite different from each other.
3. The operating bands of the set and the exciter are different from each other, and collector dissipation of the PA transistors goes to a dangerous level.
4. The output power and driving power ratio goes to less than 3:1.

5. The ALC control cable is disconnected, or the ALC level adjustment is improper.

In each case, the amplifier is turned OFF and the driving power is fed to the load directly.

COOLING FAN

IC-2KL and IC-2KLPS have cooling fans to maintain good ventilation. They work in the following conditions.

IC-2KL:

The cooling fan comes on when the temperature of the PA blocks exceeds 50°C in transmit mode.

IC-2KLPS:

The cooling fans come on when the temperature of the power transformer exceeds 75°C and/or the temperature of the heatsink of the voltage regulator transistors exceeds 50°C.

The fans continue to run until these temperatures drop to specified ones.

PROTECTION CIRCUIT OF IC-2KLPS

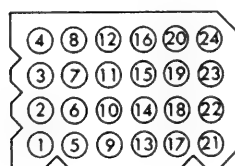
IC-2KLPS has protection circuits which function in the following conditions.

1. The output voltage is shut off when the temperature of the power transformer exceeds 135°C.
2. The output voltage is shut off when the temperature of the heatsink of the voltage regulator transistors exceeds 80°C.
3. The output voltage is shut off when the output is grounded.

When these protection circuits have been actuated, turn OFF the POWER switch of the IC-2KL first, check for the cause and correct any improper condition, then turn ON the POWER switch again.

ACC SOCKET CONNECTIONS

The table below shows terminal connections for the accessory socket.



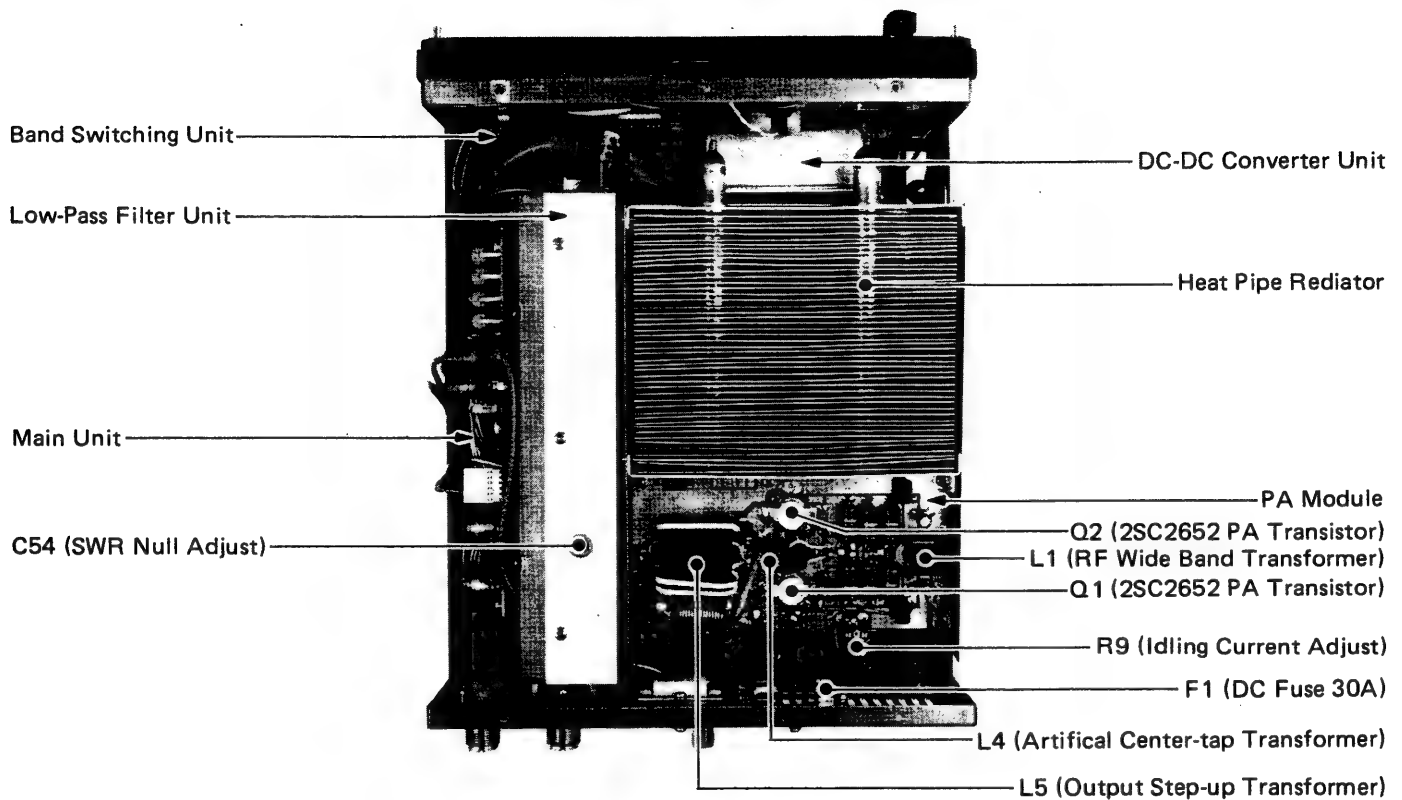
Outside view

PIN No.	FUNCTION
1. ~ 2.	NC (no connection).
3.	Connected to transmit switch circuit. When grounded, the set operates in the transmit mode.
4. ~ 6.	NC.
7.	Output for external ALC voltage.
8.	Ground.
9. ~ 11.	NC.
12.	Input for band switching control reference voltage (8V).
13.	Input for band switching control voltage.
14. ~ 24.	NC.

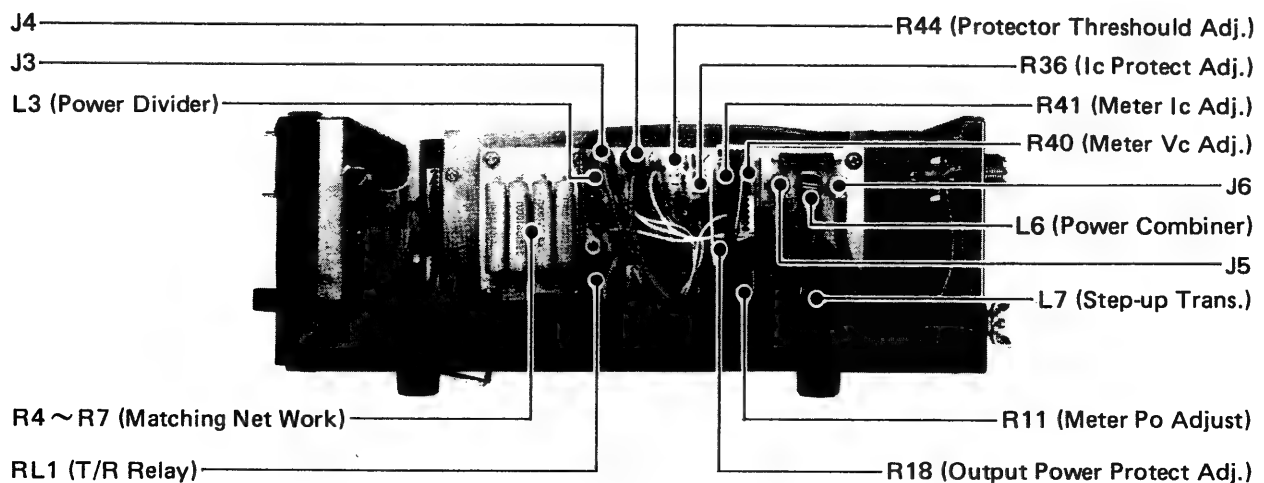
SECTION VI INSIDE VIEWS

IC-2KL

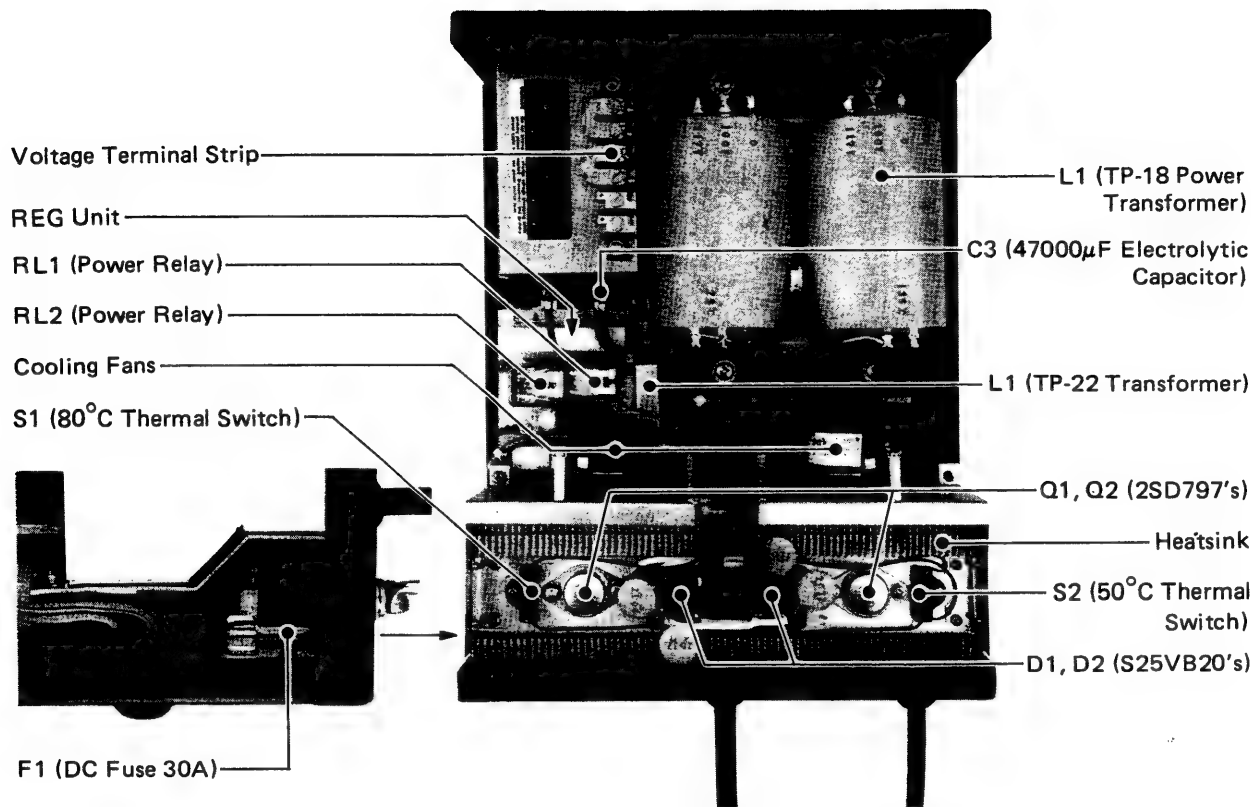
TOP VIEW



SIDE VIEW



IC-2KLPS



SECTION VII THEORY OF OPERATION

IC-2KL

The IC-2KL is an all solid-state HF 500W linear amplifier, and consists of MAIN unit, PA unit, LPF (Low-Pass Filter) unit, BAND SWITCHING unit, DC-DC Converter unit and LED unit.

INPUT CIRCUIT (MAIN UNIT)

When the linear amplifier is turned OFF, or the exciter is in the receive mode, the input terminal J1 is connected directly to the antenna connector through the contacts of RL1.

Thus the RF power from the exciter goes to the antenna or incoming signals go to the receiver directly.

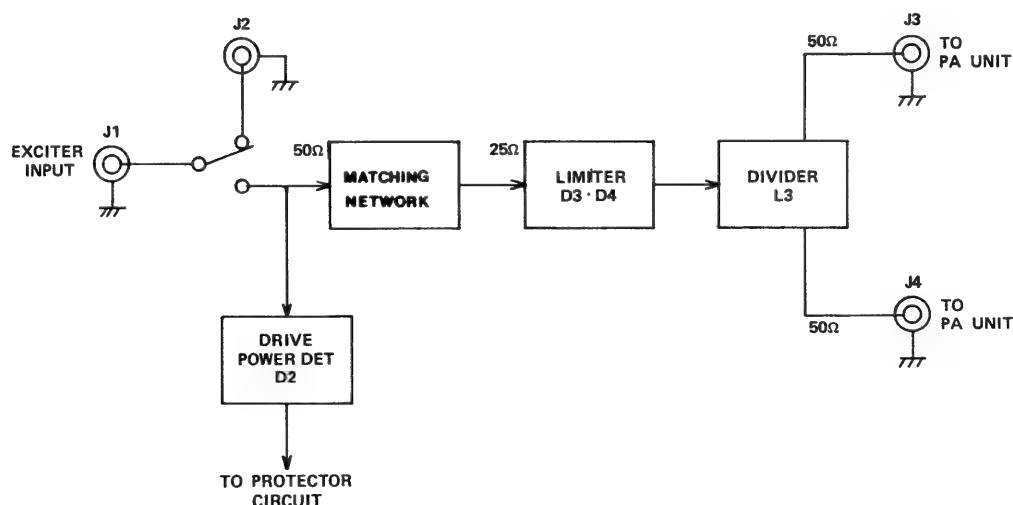
When the LINEAR AMP switch is turned ON and the exciter is in transmit mode, relay RL1 is actuated and the RF power from the exciter is applied to a matching network consisting of R4 ~ R7.

This network changes the impedance to 25 ohms for the RF power divider L3, and prevents overdriving the amplifier.

D3 and D4 comprise a clipper circuit which is biased at 40 volts. When the input signals exceed that voltage they clip the peak of the signals and keep it below the bias voltage to protect the PA units from momentary overdriving.

L3 works as a power divider for each PA unit. Each output level is balanced and its impedance is 50 ohms.

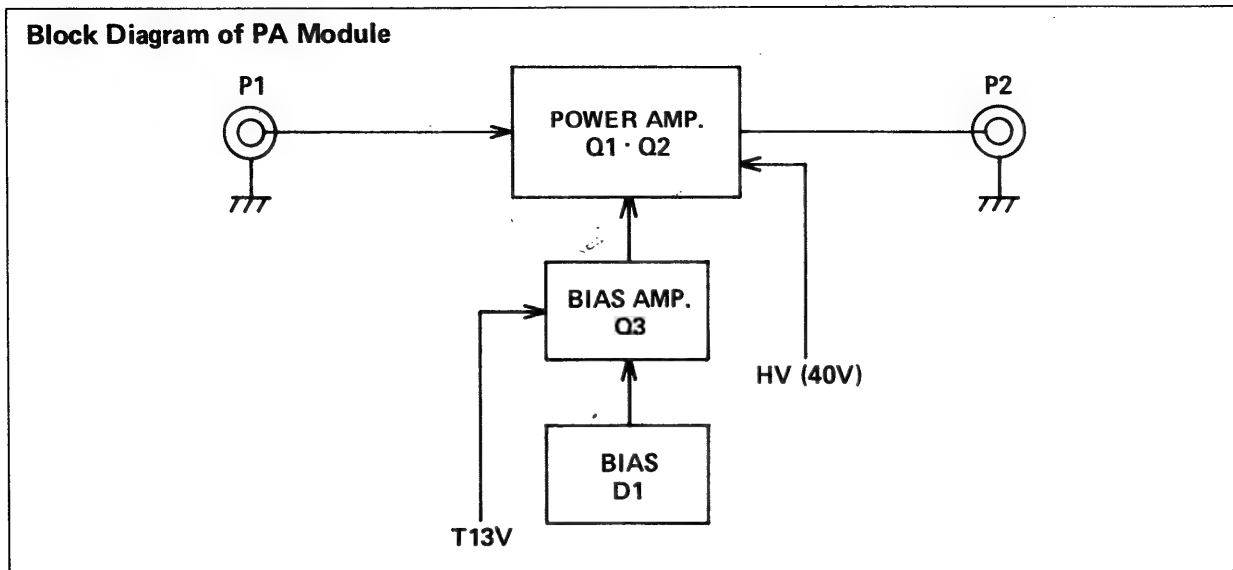
Block Diagram of Input Circuit



PA UNIT

The PA unit consists of two amplifier modules and a cooling fan. Each amplifier module has a push-pull amplifier circuit and its bias circuit, and is capable of handling 250 watts output power.

The drawing is a block diagram of the amplifier module.



Q1 and Q2 are heavy duty power transistors which are designed for HF SSB amplifiers with maximum ratings of:

V _{ceo}	55V
I _c	20A
P _c	300W

The output signals from power divider L3 are fed to each input terminal, P1, of the amplifier modules.

The signal is applied to wideband transformer, L1, which has 9:1 impedance ratio, then fed to the bases of the power amplifier transistors, Q1 and Q2.

An input frequency-correction network and an RF negative feedback network are employed to give a gain flatness response of better than $\pm 1.5\text{dB}$ across the band.

The collector transformer, L4, provides an artificial center-tap for L5. This produces even-harmonic cancellation. Additionally L4 is a low-impedance point that supplies negative feedback voltage through a separate one-turn winding.

L5 is a 1:4 step-up transformer for a 50 ohm load.

Q3 and D1 comprise the bias control circuit for Q1 and Q2.

D1 is attached to Q1 and detects its temperature, and controls the bias voltage to prevent runaway. The idling current of Q1 and Q2 can be adjusted by R9, and is set 200mA at the factory.

The PA unit has two thermal sensors. The first turns the cooling fan ON when the temperature of the heatsink exceeds 50°C. The other turns it ON when the temperature exceeds 80°C, and controls the protection circuit.

COMBINER CIRCUIT (MAIN UNIT)

The RF output power of each amplifier module is fed to the RF power combiner, L6 through J1 and J2. L6 combines RF power from both amplifier modules keeping them balanced and puts out 500 watts RF output power.

If each RF output power of the modules becomes highly unbalanced a winding of L6 picks this up and puts out a control signal to the protection circuit.
L7 is a step-up transformer for a 50 ohm load.

LOW-PASS FILTER UNIT

This unit consists of low-pass filters for each band (18MHz and 21MHz, and 24MHz and 28MHz use the same filters.), VSWR detecting circuit, T/R relay and low-pass filter selecting relays. Each low-pass filter is a 5 pole Chebyshev low-pass filter and has a 45dB attenuation level. These filters are selected for an operating band by selecting relays RL1-RL14.

L29 is a directional coupling coil, and detects forward power and reflected power. These detected signals are rectified by D8 and D9, and control the power output meter and the protection circuits. RL15 is a Transmit/Receive switching relay and is ganged with RL1 of the input circuit. These relays are actuated when the LINEAR AMP switch is turned ON and the exciter is in transmit mode. R6 is a surge absorber which discharges any very high voltage, such as static voltage of an antenna, or lightning.

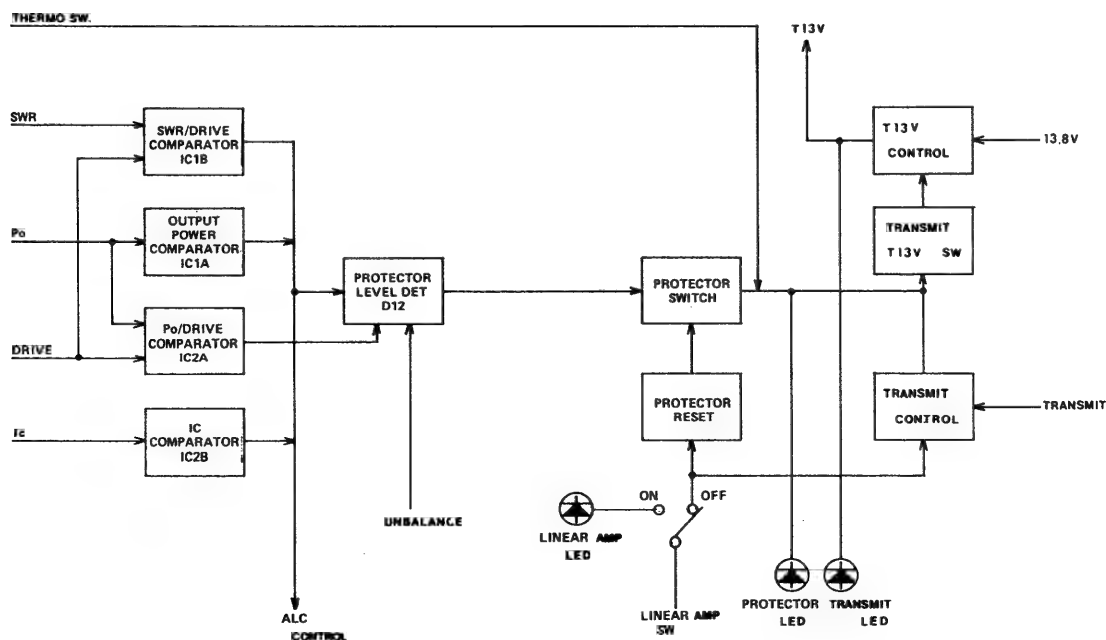
PROTECTION CIRCUIT (MAIN UNIT)

This circuit is comprised of four comparators and power supply switching circuits.

The comparators detect several operating conditions of the set, and put out the ALC control voltage according to operating conditions.

If operating conditions become abnormal, the power supply will be shut off and the set will be protected from damage.

Block Diagram of Protection Circuit



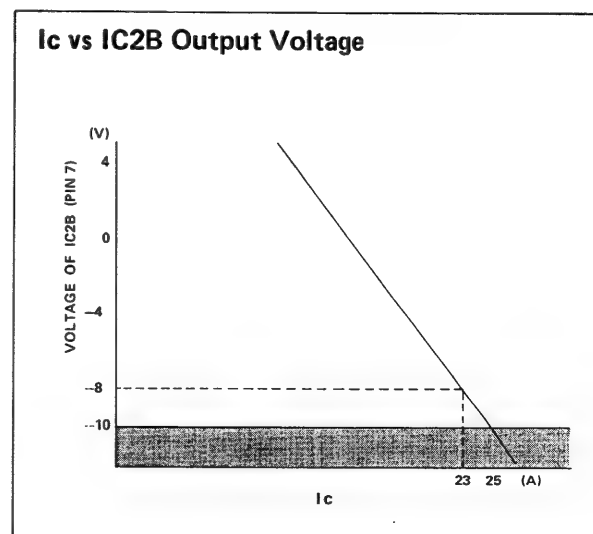
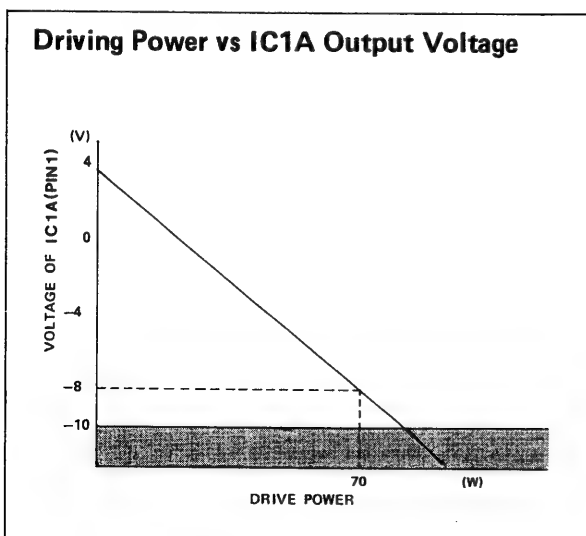
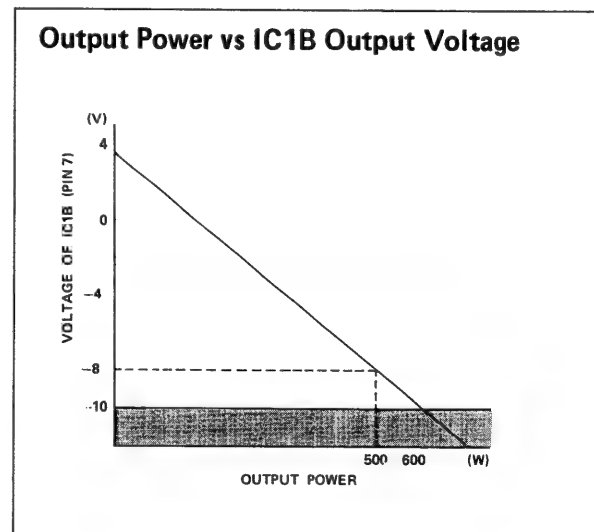
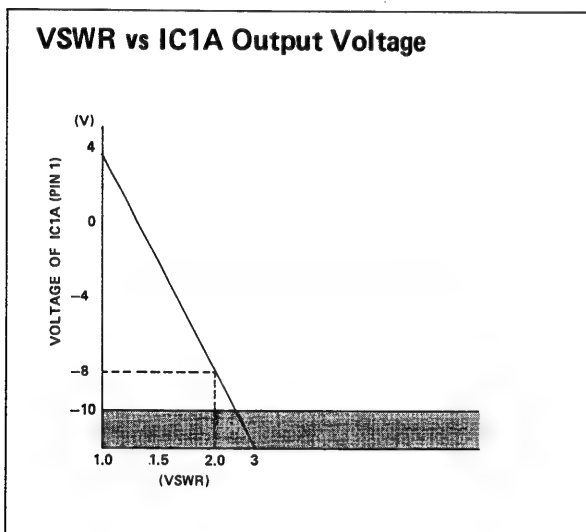
IC1A is a comparator which detects the VSWR and puts out -8 volts ALC voltage when VSWR is 2.0. If its output voltage becomes -10 volts (VSWR: 2.5), the power supply (T13V) will be shut off.

IC1A detects the driving power too, and puts out -8 volts ALC voltage when the driving power is 70 watts. If the power reaches 90 watts (ALC voltage is -10V), T13V will be shut off.

IC1B detects the output power and puts out -8 volts ALC voltage when the output power is 500 watts. If the output power reaches 600 watts, IC1B puts out -10 volts and T13V will be shut off.

IC2B detects collector current of the PA transistors (I_c), and puts out -8 volts ALC voltage when the I_c is at 23 amperes. If the I_c reaches 25 amperes (ALC voltage is -10V), T13V will be shut off.

IC2A detects a ratio of the output power and the driving power. If the ratio is less than 3:1, T13V will be shut off. (The output voltage is not used for ALC.)



When the LINEAR AMP switch is turned ON and the exciter is in the transmit mode, the base of Q4 is grounded by the exciter's T/R switch or relay, Q4 is turned OFF, and a High level voltage is applied to the base of Q5. Thus, Q5 is turned ON, power supply driving transistors Q6 and Q7 are turned ON, T13V is applied to the PA unit, and the set is actuated.

When the LINEAR AMP switch is turned OFF, 13 volts is applied to the base of Q4, and Q4 is turned ON even if the exciter is in the transmit mode. Thus, Q5, Q6 and Q7 are turned OFF, T13V is not applied, and the set is not actuated. So the output power of the exciter is fed to the antenna directly.

When the output voltage of the comparators becomes -10 volts, or the unbalanced detection voltage from L6 becomes -3 volts, Q2 and Q3 are turned ON, the base of Q5 goes near ground level. Thus Q5, Q6 and Q7 are turned OFF and T13V is shut off. At the same time the base of Q2 is grounded through D10, R48 and Q3, and Q2 and Q3 hold a TURNED-ON condition until the LINEAR AMP switch is turned OFF.

When the LINEAR AMP switch is turned OFF, High level voltage is applied to the base of Q2 through D13, Q2 and Q3 are turned OFF, and are reset to their previous condition.

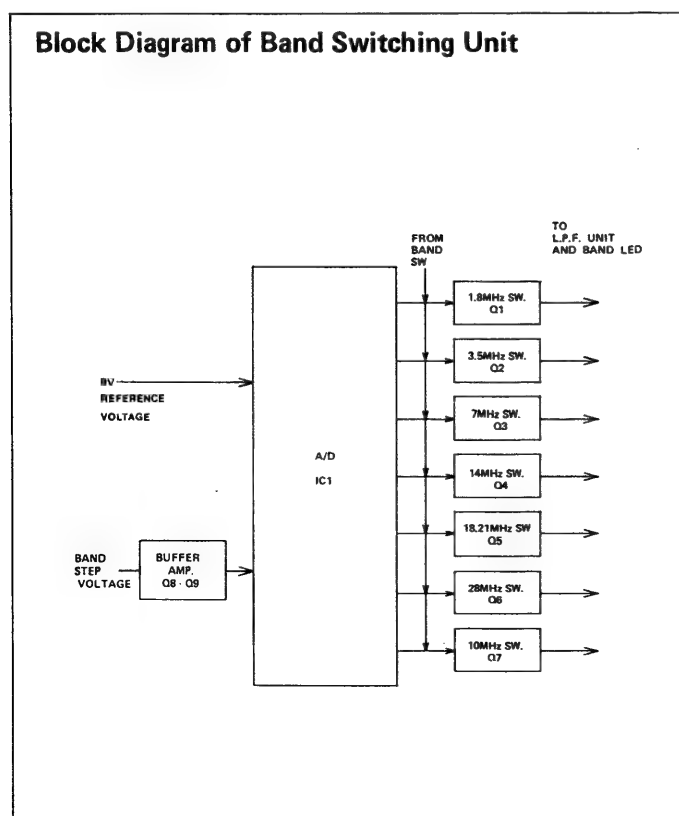
When the temperature of the PA heatsink exceeds 80°C , the thermal switch is closed and grounds the base of Q5 through D15. Thus T13V is shut off.

The forward power voltage from D8 of the LPF unit is amplified by Q1 and charges C6 to hold its peak value, then it is fed to the meter and indicates PEP output power.

BAND SWITCHING UNIT

When using an IC-701 or IC-720(A) as an exciter, the band control voltages and reference voltage are fed to IC1 through buffer amplifiers Q8 and Q9.

IC1 compares band control voltage with the reference voltage and turns ON the relay control transistor for the selected band.



Band Control Voltage Chart

BAND (MHz)	Band Control Voltage
1.8	7.0 ~ 8.0V
3.5	6.0 ~ 6.5V
7	5.0 ~ 5.5V
14	4.0 ~ 4.5V
18 - 21	3.0 ~ 3.5V
24 - 28	2.0 ~ 2.5V
10	0 ~ 1.2V

When the BAND switch is in other positions, RL1 is opened, and the band control voltages and reference voltage are not fed to IC1. Instead of this, the base of the relay control transistor for the selected band is grounded through the contact of the band switch, the transistor is turned ON, and the relays for the band in the LPF unit are actuated.

NOTE: The U.S.A. version does not work on 24MHz and 28MHz bands. When using an IC-701 or IC-720(A) as an exciter, and 24MHz or 28MHz is selected, one of the relay control transistors Q6, is turned ON. However, its collector is connected to the base of Q4 in the MAIN unit and the T13V is shut off. Thus, the linear amplifier does not work and the output power of the exciter is fed directly to the antenna.

DC-DC CONVERTER UNIT

This unit generates +13.8V and -13.8V for the protection circuit and other control circuits from DC 40V which is supplied from IC-2KLPS. Q1 and Q2 oscillate about 14KHz, and switch the DC 40V to convert it to an AC voltage. The AC voltage is stepped down by transformer L2, and rectified by D5 and D6 for -13.8V, and by D7 for +13.8V. These voltages are smoothed, then applied to other circuits.

IC-2KLPS

The IC-2KLPS is an attendant AC power supply for the IC-2KL linear amplifier, and puts out 40V $\pm 3V$, 25A maximum.

When turning the power switch of the IC-2KL ON, first, power relay RL1 is actuated, and AC primary voltage is applied to power transformer L1 through the contacts of RL1, R5 and R6. R5 and R6 reduce a rush-current which is fed into the power supply.

After a moment, relay RL2 is actuated and its contacts make short circuits of R5 and R6, thus, AC primary voltage is applied to L1 directly. The time delay of RL2 is caused by time-constant of R3 and C1.

AC voltage, stepped down by the power transformer L1, is rectified by D1 and D2, and smoothed by C3, then applied to voltage control transistors Q1 ~ Q3. The base of Q3 is controlled by Q1 in the REG unit, which compares output voltage of Q1 and Q2 with a reference voltage of Zener diodes D3 and D4 (D5 is a temperature-compensating diode), and puts out a control voltage.

The IC-2KLPS has protection circuits which control cooling fans and shut off the output voltage (DC 40V).

The power transformer L1 has two thermal switches. The first is closed at 75°C, and turns the cooling fans on. The other is closed at 135°, and grounds the base of Q1 in the REG unit and shuts off the output voltage.

The heatsink of the voltage control transistors Q1 ~ Q3, also has two thermal switches. The first is closed at 50°C and turns the fans on. The other is closed at 80° and grounds the base of Q1 in the REG unit.

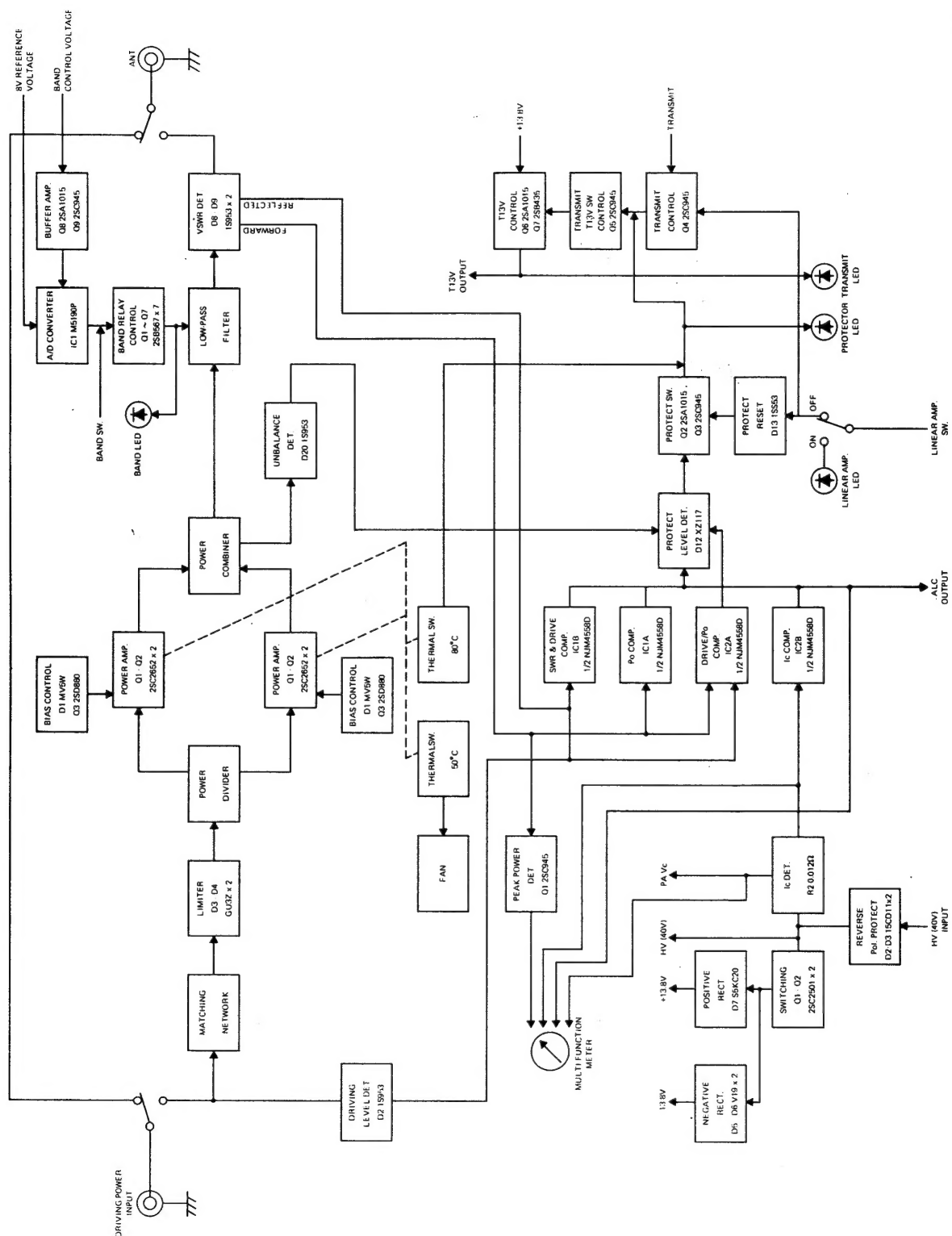
SECTION VIII TROUBLE SHOOTING

Your IC-2KL and IC-2KLPS have been tested very carefully at the factory before shipping. The chart below has been designed to help you correct any problems which are not equipment malfunctions. If you are not able to locate the problem and/or solve it through use of this chart please contact your dealer or ICOM distributor for assistance.

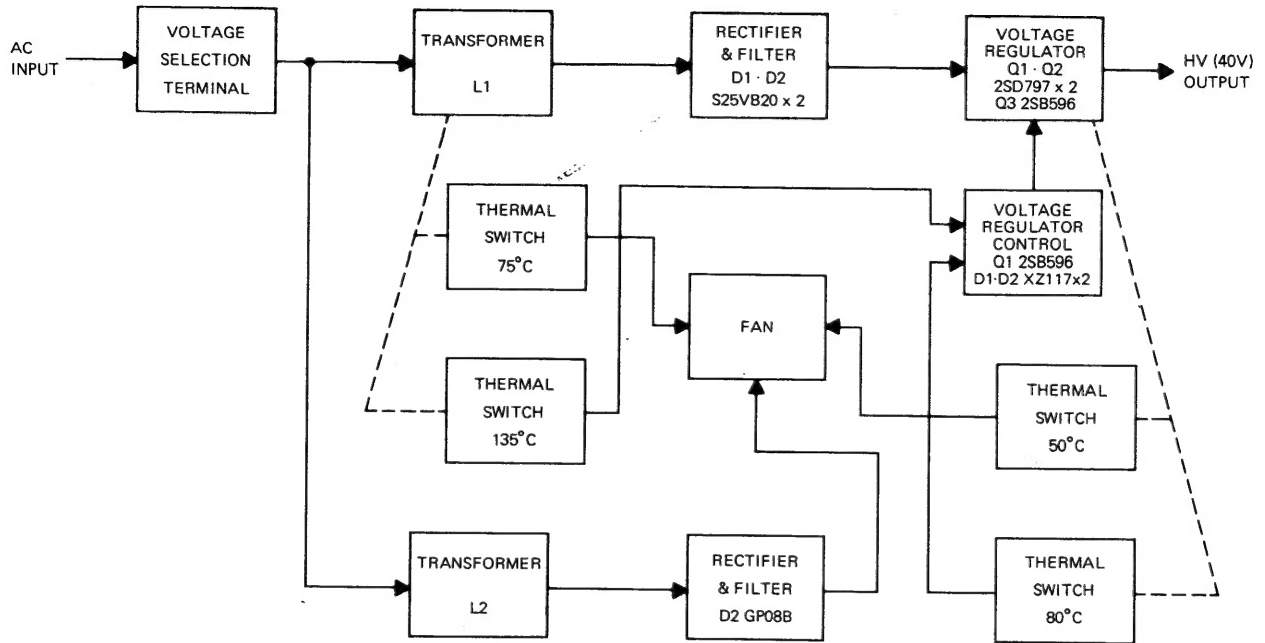
Problem	Possible Cause	Solution
<p>1. Power does not come ON when the power switch is turned ON.</p> <p>① Pilot lamp of IC-2KLPS does not light.</p> <p>② Pilot lamp of IC-2KLPS lights, but no DC output voltage.</p>	<p>Internal voltage terminal connections are improper for AC primary voltage.</p> <p>Power cord is improperly connected.</p> <p>Blown AC fuse of IC-2KLPS.</p> <p>The output line has a short circuit, and the protection circuit has been actuated.</p> <p>Protection circuits have been actuated by exceeding specified temperature of the power transformer and/or the heatsink. (At this time, the cooling fans are turning.)</p> <p>Blown DC fuse of IC-2KLPS.</p>	<p>Carefully reconnect the terminal connections for desired voltage. (Refer to instructions on page 4.)</p> <p>Check the connector and carefully reconnect the power cord.</p> <p>Check for the cause and correct any improper condition, then replace the fuse with a new one (10A).</p> <p>Turn OFF the POWER switch of IC-2KL first, check for the cause and correct any improper condition, then turn ON the POWER switch again.</p> <p>Wait until the temperature drops to a safe level. (The fans will be stopped), then turn OFF the POWER switch and turn it ON again.</p> <p>Check for the cause and correct any improper condition, then replace the fuse with a new one (30A).</p>
<p>2. No output power.</p>	<p>Mistaken an antenna feeder for a cable from the exciter.</p> <p>Bad connection of cable connectors.</p> <p>Band switch is in AUTO position. (When using IC-720 which does not have the LDA unit installed.)</p> <p>(When using a transceiver other than ICOM.)</p> <p>(Band indicator is not lit.)</p>	<p>Make proper connections.</p> <p>Check the connectors and correct any improper condition.</p> <p>Install the LDA unit, or set the band switch to desired operating band.</p> <p>Set the band switch to desired operating band.</p>
<p>3. Low output power. (100 ~ 400W)</p>	<p>Driving power is not sufficient.</p> <p>AC line voltage has dropped or improper.</p>	<p>Tune-up the exciter.</p> <p>Use an exciter which has more output power.</p> <p>Use an AC outlet which is capable of 1.6KW or more, and good regulation.</p> <p>Change voltage terminal connections for proper primary voltage. (Refer to page 4.)</p>

Problem	Possible Cause	Solution
3. Low output power. (Continued)	<p>SWR of antenna system is too high.</p> <p>Improper or no ALC adjustment.</p> <p>Operating bands of the IC-2KL and the exciter are different. (When the exciter's band is lower than IC-2KL's.)</p>	<p>Check the antenna, feed line and antenna tuner (when used), and correct any improper condition.</p> <p>Adjust the ALC ADJ control according to the instructions on page 10.</p> <p>Set both operating bands the same. When IC-701 or IC-720(A) is used as an exciter, set the band switch of IC-2KL to "AUTO" position.</p>
4. Very low output power. (The driving power is fed to antenna directly.)	<p>Protection circuits have functioned, and IC-2KL does not work. (Protection indicator is lit.)</p> <p>LINEAR AMP switch is in OFF position. (Linear amp indicator is not lit.)</p> <p>Bad connection of ACC socket or T/R control terminal. (Transmit indicator is not lit.)</p> <p>Control cable is cut.</p> <p>Blown DC fuse of IC-2KL.</p>	<p>Turn OFF the LINEAR AMP switch first, check for the cause and correct any improper condition. (Refer to "PROTECTION CIRCUIT" on page 11.) Then turn ON the LINEAR AMP switch again.</p> <p>Turn ON the LINEAR AMP switch.</p> <p>Check the connection and correct any improper condition.</p> <p>Repair disconnected or cut wire.</p> <p>Check for the cause and correct any improper condition, then replace the fuse with a new one (30A).</p>

IC-2KL



IC-2KLPS





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